REMARKS

Claims 9-16 are presently pending in the application. Reconsideration and allowance of all claims are respectfully requested in view of the following remarks.

The Examiner has rejected Claims 10-16 under 35 U.S.C. 112, second paragraph, as being indefinite. Claim 10 has been amended in accordance with the Examiner's suggestion for the purposes of clarity only, which should obviate the Examiner's rejection of Claims 10-16.

The Examiner has rejected Claims 10 and 16 under 35 U.S.C. 102(b) as being anticipated by Bandyopadhyay et al. Claim 9 was rejected under 35 U.S.C. 103 as being unpatentable over Holland in view of Rahn. Claims 10-16 were rejected under 35 U.S.C. 103 as being unpatentable over Vrieze et al. in view of Holland and further in view of Rahn and Nulman. For the following reasons, the prior art rejections are respectfully traversed.

The present invention relates to a method of producing an optical component having a multi-layer film composed of alternately stacked layers on a base, the layers which are different in optical characteristics. The thickness of one layer of the multi-layer film is controlled on the basis of a measured optical characteristic of the optical component.

Bandyopadhyay et al. disclose a method of making a tantala/silica interference filter on a vitreous substrate, by applying two coatings on the substrate and heat treating the first and second coatings.

The Applicants respectfully submit that Bandyopadhyay et al. do not teach or suggest the step of controlling a thickness of one layer of the plurality of optical layers, by (a) depositing a tuning layer on the surface of the plurality of optical layers to form a stack, wherein the tuning layer is the one layer and defines a thickness, (b) measuring an optical characteristic of the stack to obtain a first optical characteristic value, (c) measuring the optical characteristic of the stack after continued deposition to obtain a second optical characteristic value, (d) determining whether the second optical characteristic

value has decreased as compared to the first optical characteristic value, and (e) when the second optical characteristic value has not decreased, continuing the depositing of the tuning layer to add to the stack and returning to steps (ii)(b)-(e), and when the second optical characteristic measured has decreased, terminating the depositing of the tuning layer, as recited in Claim 10.

Rather, as the Examiner admits on page 6 of the Office Action, Bandyopadhyay et al. are silent with respect to these steps.

Accordingly, Claim 10 is not anticipated by Bandyopadhyay et al., and the rejection of Claim 10 under 35 U.S.C. §102(b) should be withdrawn.

Holland discloses an apparatus for controlling the deposition of a thin film on a substrate, where the optical transmittance is sensed, and where the deposition can be terminated at a suitable thickness, for example, a transmittance maximum or minimum.

Rahn discloses a plurality of films of interleaved low and high index of refraction material, where a portion of the outer film is removed to correct for errors in both the outer layer and the inner layer thicknesses.

The Applicants respectfully submit that neither the individual nor the combination of the Holland and Rahn references teaches or suggests the steps of removing a layer portion formed during a period of time from a time point when the increase/decrease of the measured mean light transmittance of the optical component is stopped to a time point when the measured mean light transmittance is changed to be decreased, as recited in Claim 9.

First, the Applicants submit that there is motivation to combine Rahn with Holland to achieve the claimed features of the present invention. Rather, Holland teaches a precise control of final film thickness by controlling a rate of deposition, where deposition of the film is stopped at a suitable thickness using the optical transmittance of the deposited film.

In contrast, the Rahn reference assumes that the films produced are not manufactured to the correct thickness which cause the structure to be anti-reflective, so milling and chemical etching of the outer film must be conducted in order to correct for errors in outer layer and inner layer thickness (see Rahn, col. 2, lines 20-32).

Accordingly, there is no motivation to combine Rahn with Holland, since with the Holland technique, the need for chemical etching and milling that is taught in Rahn, is obviated. The Applicants respectfully submit that the Examiner is using impermissible hindsight in picking and choosing references which teach various elements of the claims in order to meet the claimed features of the present invention.

Still further, Rahn, on whom the Examiner relies for removal of the layer portion, is silent with respect to the removal being conducted during the period when the measured mean light transmittance is stopped and then decreased. Rahn discloses only that an outer film can be etched to a critical thickness by chemical etching or milling, but does not specify during which time period.

Accordingly, Claim 9 is not obvious over either the individual or the combination of the Holland and Rahn references, and the rejection of Claim 9 under 35 U.S.C. §103 should be withdrawn.

Vrieze et al. disclose a cathode ray tube having a multi-layer interference filter, the filter having alternate layers with high and low refractive indices.

Nulman discloses a method of monitoring the deposition rate of films during physical vapor deposition, by the measurement of optical attenuation.

The Applicants respectfully submit that neither the individual nor the combination of the Vrieze et al., Holland, Rahn, and Nulman references teaches or suggests the step of controlling a thickness of one layer of the plurality of optical layers, by (a) depositing a tuning layer on the surface of the plurality of optical layers to form a stack, wherein the tuning layer is the one layer and defines a thickness, (b) measuring an optical characteristic of the stack to obtain a first optical characteristic value, (c) measuring

the optical characteristic of the stack after continued deposition to obtain a second optical characteristic value, (d) determining whether the second optical characteristic value has decreased as compared to the first optical characteristic value, and (e) when the second optical characteristic value has not decreased, continuing the depositing of the tuning layer to add to the stack and returning to steps (ii)(b)-(e), and when the second optical characteristic measured has decreased, terminating the depositing of the tuning layer, as recited in Claim 10.

First, as stated above, there is no motivation to combine Holland with Rahn. Thus, the combination of the Vrieze et al. and Nulman references with Holland and Rahn would not be obvious in meeting the claimed features of the present invention as recited in Claim 10.

Further, none of the applied prior art references teach that one layer - a tuning layer - should be measured for its optical characteristics, such that if the optical characteristic increases/decreases, that the deposition of the tuning layer should be continued/terminated, respectively. Rather, although the control of the deposition rate using optical characteristics is disclosed in the references, using the optical characteristics to achieve a certain thickness of the tuning layer by continuing or terminating deposition, is not disclosed in any reference.

Contrary to the Examiner's assertion that Rahn teaches this feature, the Applicants respectfully submit that Rahn simply discloses that excess thickness or errors in thickness of the outer layer (which is not necessarily the tuning layer of the present invention) are handled by the removal of the excess by chemical etching or milling. This is no way teaches that the thickness of the layer is controlled by the optical characteristics.

Further, contrary to the Examiner's assertion that Holland discloses this feature, the Applicants respectfully submit that Holland only discloses terminating deposition at a maximum or minimum reflectance, whereas the present invention does not terminate deposition at a maximum or minimum

reflectance, but rather, deposition is continued or terminated based on a thickness of the tuning layer and its optical characteristics.

Thus, the present invention is patentably distinguishable from the Rahn and Holland references, and the addition of the Vrieze et al. and Nulman references, which are silent with respect to the control of the thickness of the tuning layer and its relation to the optical characteristics of the optical component, cannot meet the claimed features of the present invention as recited in Claim 10.

Accordingly, Claim 10 is not obvious over either the individual or the combination of the Vrieze et al., Holland, Rahn, and Nulman references, and the rejection of Claim 10 under 35 U.S.C. §103 should be withdrawn.

With respect to Claim 11, the Applicants respectfully submit that neither the individual nor the combination of the Vrieze et al., Holland, Rahn, and Nulman references, teaches or suggests the step of removing a layer portion formed during a period of time from a time point when the increase/decrease of the measured mean light transmittance of the optical component is stopped to a time point when the measured mean light transmittance is changed to be decreased.

Rather, as stated above with respect to Claim 9, there is motivation to combine Rahn with Holland to achieve the claimed features of the present invention.

Still further, as stated above with respect to Claim 9, Rahn, on whom the Examiner relies for removal of the layer portion, is silent with respect to the removal being conducted during the period when the measured mean light transmittance is stopped and then decreased. Rahn discloses only that an outer film can be etched to a critical thickness by chemical etching or milling, but does not specify during which time period.

Vrieze et al. and Nulman do not make up for the deficiencies in Holland and Rahn.

Accordingly, Claim 11 is not obvious over either the individual or the combination of the Vrieze

et al., Holland, Rahn, and Nulman references, and the rejection of Claim 11 under 35 U.S.C. §103 should be withdrawn.

Further, since Claims 11-16 depend from Claim 10, they are also patentably distinguishable over either the individual or the combination of the Vrieze et al., Holland, Rahn, and Nulman references, for the reasons cited above with respect to Claim 10.

If the Examiner believes that there is any issue which could be resolved by a telephone or personal interview, the Examiner is respectfully requested to contact the undersigned attorney at the telephone number listed below.

Applicants hereby petition for any extension of time which may be required to maintain the pendency of this case, and any required fee for such an extension is to be charged to Deposit Account No. 19-3140.

Respectfully submitted,

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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

Page 7, the first full paragraph was amended as follows:

The above preferable method, specifying the transmittance as the optical characteristic, according to the second aspect of the present invention, may further [includes] include a removal step of removing a layer portion formed during a period of time from a time point when the increase/decrease of the measured mean light tranmittance of the optical component is stopped to a time point when the measured mean light transmittance is changed to be decreased.

Page 8, the first full paragraph was amended as follows:

In the method according to the second aspect of the present invention, preferably, the control steps [includes] include the step of controlling a thickness of one layer of the plurality of alternately stacked layers, the one layer having a higher refractive index and being positioned near the uppermost surface remotest from the base.

Page 11, the second paragraph was amended as follows:

A running system (film formation means) [for running] runs at a constant speed, a base 3a from the feed roll 4 to the winding roll 6 by way of the guide rolls 5a, 5b, 5c, 5d, and 5f. The plasma electrode 8, which is used for preparation such as degassing of the base 3a, is opposed to a portion, disposed between the guide rolls 5a and 5b, of the base 3a. The evaporation sources 7a and 7b, each of which is configured typically as a sputtering system, are disposed with their targets opposed to the guide roll 5d. The target is made from Si, Nb or the like as an optical thin layer material.

Page 13, the third paragraph, continuing to page 14, was amended as follows:

The optical head 10g has a light emitting unit 12 and a light receiving unit 13. The light emitting unit 12 is a light source enabling continuous emission of light having a wavelength of 450 to 700 nm, that is, a light source having a continuous spectrum of 450 to 700 nm in wavelength. The light emitting unit 12 is configured as an LED (Light Emitting Device). The light receiving unit 13 is configured as a photodiode for detecting a continuous spectrum of 450 to 700 nm in wavelength. The light emitting unit 12 and the light receiving unit 13 are opposed to each other with the running base 3a put therebetween. The light emitting unit 12 is connected to the light source 10c. The light source 10c [is], in principle, supplies a specific quality of light. An optical communication line 10b extending from the switch 10f is connected to a mid point of the communication line between the light emitting unit 12 and the light source 10c.

IN THE CLAIMS:

The claims were amended as follows:

9. (Amended) An optical component producing method for forming a multi-layer film, which is composed of alternately stacked layers different in optical characteristic, on a base, the method comprising:

measuring an optical characteristic of the optical component obtained by forming the multi-layer film on the base, wherein the measurement step comprises the step of measuring a transmittance of the optical component;

controlling, on [the] a basis of the measured optical characteristic of the optical component, a thickness of a portion of the multi-layer film to be formed on the base by terminating the film formation at the portion of the multi-layer film when the measured transmittance of the optical component is changed to be decreased; and

removing a layer portion formed during a period of time from a time point when the increase/decrease of the measured mean light transmittance of the optical component is stopped to a time point when the measured mean light transmittance is changed to be decreased.

10. (Amended) A method for forming an optical component, comprising:

(i) depositing a plurality of optical layers on a base to form a surface; and

(ii) controlling a thickness of [no more than] one layer of said plurality of optical layers, by

(a) depositing a tuning layer on the surface of the plurality of optical layers to form a stack, wherein the tuning layer is the [no more than] one layer and defines a thickness,

(b) measuring an optical characteristic of the stack to obtain a first optical characteristic value,

(c) measuring the optical characteristic of the stack after continued deposition to obtain a second optical characteristic value,

(d) determining whether the second optical characteristic value has decreased as compared to the first optical characteristic value, and

(e) [if] when the second optical characteristic value has not decreased, continuing the depositing of the tuning layer to add to the stack and returning to steps (ii)(b)-(e), and [if] when the second optical characteristic measured has decreased, terminating the depositing of the tuning layer.